Pacific Science (1982), vol. 36, no. 1

Mass Expulsion of Zooxanthellae by Easter Island Corals[1]

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ABSTRACT: Hermatypic corals of Easter Island lost their zooxanthellae following a torrential downpour in mid-June 1980. Whitened corals were seen islandwide in a patchy distributional pattern. Corals recovered their coloration within 2–3 months. This was the only occurrence of this phenomenon in memory of the older islanders, which spans a period in excess of 50 yr.

EASTER ISLAND (27°10′ S; 109°20′ W) lies at the extreme southeast part of the Indo-Pacific region. It has no structural reefs and hosts a depauperate fauna exemplified by its few species of corals (Wells 1972), mollusks (Rehder 1980), and fishes (Randall and McCosker 1975). The invertebrate fauna of the island is poorly known, and we are unaware of any ecological studies characterizing the island's inshore ecosystem. This note records an unusual occurrence of mass expulsion of zooxanthellae by Easter Island corals in mid-1980.

Easter Island currently has a small population, numbering slightly over 2000 people. Except for tourism, the island has few sources of outside income, one of which is the export of souvenir coral heads. Small colonies of *Pocillopora danae* are collected to depths of 15 m at various locations around the island. Upon return to shore, the corals are cleaned and bleached until bone-white and then dried. They are exported by boat or plane, usually to the Chilean mainland.

Both coral divers and spearfishermen have had unobstructed underwater vision since 1927 when the first diving goggles were introduced to the island. Subsequent to an unusually heavy rainfall on 16 June 1980, the coral divers noticed that coral heads of commercial value had begun to turn white on an islandwide basis. At first, the divers became encouraged to collect these corals, as it appeared they were dead, bleached, and in condition for immediate sale. When these corals went through typical (malodorous) decomposition after landing, some divers referred this problem to island officials, because they were afraid that the alteration of the corals was due to pollutants, air traffic, or other development-linked causes that would threaten their enterprise. Freshly formalin-fixed specimens of affected corals were sent to us for examination in August 1980. One of us (Cea), with extensive scuba diving experience on Easter Island, explored and photographed some coral growth areas in early September 1980 and in mid-March 1981. During these visits, interviews were conducted with some islanders to document the event.

OBSERVATIONS

Interviews with divers suggested that all coral growth areas on the island had been affected by "bleaching," at least to depths of 10 m, below which no observations were made. The three major species of island hermatypes were affected, including *Pocillopora danae*, *P. damicornis*, and *Porites lobata*. There are no data available to quantify the percentage of corals affected, although the divers observed that white corals occurred in patchy, discontinuous zones. Recovery occurred gradually, reaching completion in 2–3 months. Figure 1 shows a colony of *Porites lobata* photographed in early September 1980 (10 wk after the event) which as yet showed incomplete regeneration of algal symbionts. Revisitation in March 1981 showed full re-

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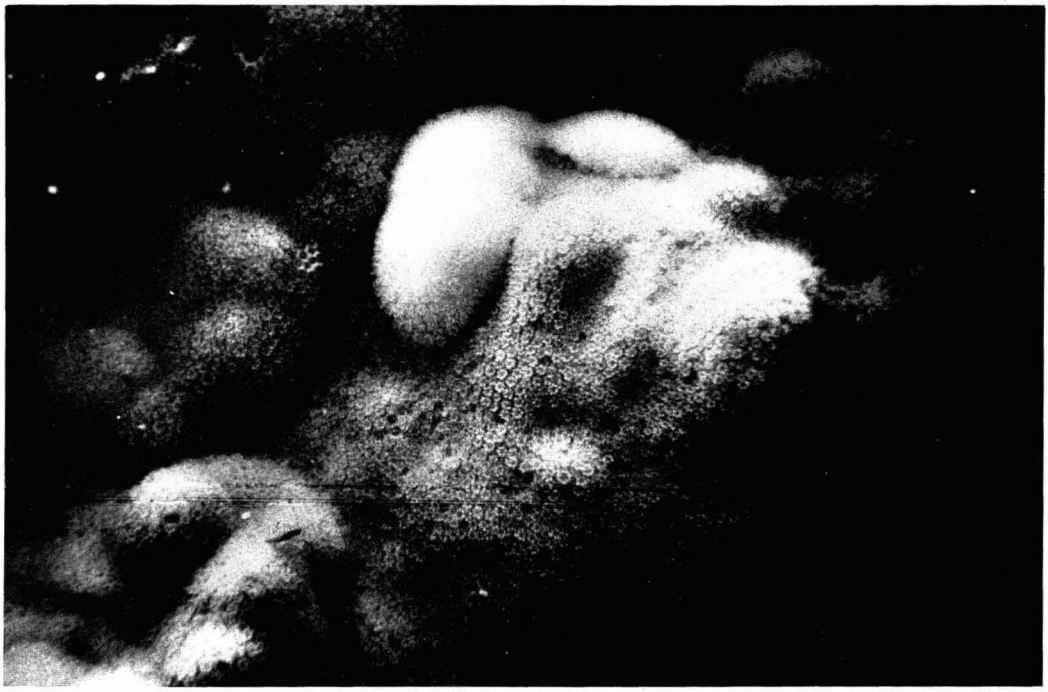

FIGURE 1. Part of a large colony of *Porites lobata* photographed at 7 m depth near Motu Tautara, Easter Island, in September 1980. Pure white regions indicate polyps devoid of zooxanthellae, dating from an unusually heavy rainfall on 16 June 1980.

covery of corals with no overt evidence of mass mortality.

Specimens of *Pocillopora danae* collected 3 wk after the event and examined microscopically showed complete absence of algal symbionts. The polyps were transparent, although retracted, and apparently were not atrophied. Indeed, no atrophy is apparent in any polyps seen in Figure 1.

Data obtained from the weather station at Easter Island show rainfall on 16 June 1980 of 97.6 mm within a 24-hr period. This was 68 percent of the rainfall for that month and 7 percent of the rainfall for the year (1350 mm), which normally averages 1250 mm. The most rainfall recorded for any other day of 1980 was 64.5 mm on December 12.

DISCUSSION

Mass expulsion of zooxanthellae is a well-recognized phenomenon, although it occurs rarely. Coral discoloration of this nature had never occurred on Easter Island in memory of island divers and spearfishermen, some of whom were 80 yr of age when interviewed. Goreau (1964) documented the occurrence of coral whitening in Jamaica, presuming that the expulsion of the algal symbionts from the coral was induced by osmotic stress due to the abrupt lowering of salinity in surface waters impinging on reefs. He discounted the possibility of sedimentation causing the effects, because corals in deeper waters were not affected, although these were subject to greater shading and sedimentary deposition.

Heavy rains are not unusual on Easter Island, but the rain of 16 June 1980 was a remarkable event. Roads that had never been damaged by rain in the memory of the oldest islanders were washed out. A layer of silty water persisted around the island for several days; since divers on the island traditionally do not enter the water until it has

cleared, there is no accurate information as to time and rate of the coral whitening process. Similar sedimentation had been seen in the past without effect on the corals. In the absence of more accurate data, and on the basis of Goreau's (1964) report, we assume salinity was lowered enough in the water surrounding Easter Island to cause an osmotic stress sufficient to induce symbiont expulsion.

Both Goreau (1964) and Franzisket (1970) have commented on the dynamic relationships between zooxanthellae and their coral hosts with regard to the phenomenon of expulsion. Figure 1 suggests that the polyps of *Porites lobata*, even when free of zooxanthellae for 10 wk in situ, did not undergo atrophication such as that experimentally induced in the laboratory by Franzisket (1970). This was probably because of greater availability of zooplankton to polyps in the environment in contrast to that available in laboratory tanks. Loss of zooxanthellae would probably affect calcification processes in the coral which cannot be detected by simple observation.

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